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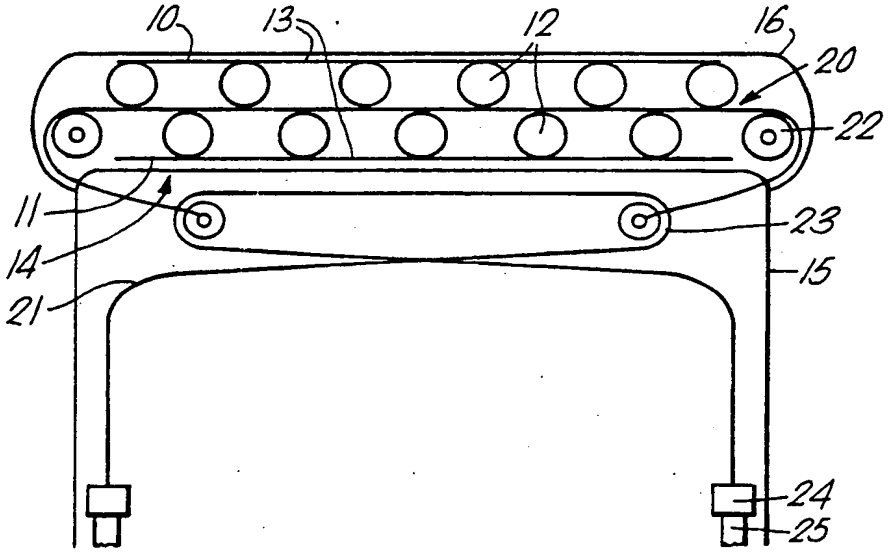

(57) Abstract

A seat belt tensioner for use with a vehicle characterised in comprising a first contoured surface (11) associated with a body of the vehicle (15) and a second surface (10) associated with a bumper (16) mounted on the vehicle, a strip member (20) disposed between them, the shape of the surfaces being such that as the two surfaces move towards each other the strip member changes shape and tends to follow the contours of the surfaces and ends of the strip member, being attached by attaching means (23) to seat belt locking retractors (24), move in a way so as to cause tightening of seat belts (25) attached to the seat belt locking retractors.

* See back of page

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SEAT BELT TENSIONER

This invention relates to a seat belt tensioner, a device which automatically tightens the seat belts of front seat occupants in a vehicle in the event of a crash.

Commonly seat belts are of the lap/diagonal inertia reel type. The inertia reel type seat belt operates in a way such that in the event of a sudden forward movement by the passenger, for example if the vehicle decelerates suddenly, the seat belt is prevented from unreeling by the action of various different locking devices and thus tightens across the passenger. This restricts dangerous forward movement of the passenger during a crash. These seat belts do, however, suffer from disadvantages: they are invariably worn too loosely, allowing for dangerous forward movement of a passenger in the event of a major collision, and the inertia reels have a relatively slow response time since they rely on the movement of the passenger before they operate or alternatively they will operate only when the vehicle's retardation is above a set level. Even after the inertia reel spindle has locked, the coil of seat belt webbing on the spindle will tighten and allow further forward movement by the passenger.

Seat belt tensioning systems are known which overcome the above problems to a certain extent, but these systems also suffer from disadvantages.

One such system was demonstrated by Mercedes-Benz (United Kingdom) Ltd in 1984. This system works by use of a sophisticated 'crash sensor' mounted over the transmission tunnel of the car. In the event of a frontal collision the crash sensor fires a small pyrotechnic charge which operates tensioners added to the conventional emergency locking retractors on the two front seats thus pulling the front seat passengers' seat belts tight and ensures maximum protection to the driver and passenger. This system does, however, have disadvantages. The main disadvantage is that the system does not rely on the car's own energy but on energy stored in the pyrotechnic charge being released by sophisticated electronic circuitry which means that if an electrical fault occurs the system could be set off accidentally which itself could cause an accident. Also, if the vehicle should encounter a particularly hard bump this could also set the system off. Because of the possibility of these events occuring the Mercedes system is designed not to pull the seat belts as

tight as might be desirable, which is another disadvantage of the system.

Another seat belt tensioning system is the Audi Procon-Ten system which relies on the backward movement of the engine and gear box during a collision for its operation. It operates by a steel cable whose ends are connected to the two inertia reel retractors for the front seat belts. The cable is run forwards from the reels, round strong points on the vehicle's front suspension, and back behind the engine and gearbox. In a severe frontal collision the engine and gearbox move backwards in relation to the suspension, pulling on the cable and tightening the belts. The main disadvantage with this system is that it will only work for a particular layout of the vehicle, namely that the gearbox is situated in line with the engine and the whole unit if mounted longitudinally in the car very close to the front of the body. This layout seems only to be used in the Audi car for which the system was designed. Moreover the system will only work if the vehicle experiences a square-on frontal collision and will not work for a front corner or angled frontal collision.

There is therefore a need for an improved seat belt tensioning device which overcomes the above-mentioned problems, namely a failsafe device which operates in any sort of frontal collision, is compatible for use with any type of vehicle and preferably operates using the car's own energy.

According to the present invention there is provided a seat belt tensioner for use with a vehicle characterised in that it comprises a first contoured surface associated with a body of the vehicle and a second contoured surface associated with a bumper mounted on the vehicle, a strip member disposed between the two surfaces, the shape of the surfaces being such that as the two surfaces come together the strip member changes shape and tends to follow the contours of the surfaces, and ends of the strip member, being attached by attaching means to seat belt locking retractors, move in a way so as to cause tightening of seat belts attached to the seat belt locking retractors.

The main advantage of the system is that it relies purely on the car's own energy for operation thus providing a fail-safe mechanism which does not rely on pyrotechnics or on electronic circuitry of any kind which can be subject to failure, and also has a fast response time.

The first surface may be formed either on or adjacent to the body of the vehicle and second surface may be formed either on or adjacent to a bumper attached to the body of the vehicle.

The surfaces may be defined by a plurality of cylindrical members mounted on mounting members and arranged such that when the surfaces come together in a collision the cylinders on one surface are forced to move into the spaces between adjacent cylinders on the other surface. The surfaces may take other configurations - for example part cylinders could be used or alternatively a continuous contoured member could be attached to the mounting means.

The strip member is preferably a belt made from conventional seat belt material and each of its ends is attached by cable to a movable pulley situated underneath the bonnet of the vehicle. A further cable runs over the two movable pulleys and down each side of the vehicle, each end being attached to conventional seat belt retractors already installed in the vehicle, to which seat belts are attached.

Alternatively the strip member could take the form of a steel strip or cable.

Another advantage of the present invention is that it is designed to operate in any type of collision, namely whenever the bumper receives an impact anywhere along its length and is not restricted to perpendicular collisions at the centre of the vehicle.

One embodiment of the present invention will now be described, by way of example only, with reference to the accompanying diagramatic drawings, in which Fig 1 is a plan view in section of one embodiment of a seat belt tensioner according to the invention;

Figs 2A and 2B are plan views in section of alternative embodiments of the two surfaces used in the invention;

Figs 3A and 3B show how the two surfaces in Fig 1 come together during a collision; and

Fig 4 is a perspective view of a device according to the invention attached to the front of a vehicle.

As shown in Fig 1 a seat belt tensioner has two contoured surfaces 10, 11 each comprising a plurality of preferably cylindrical members 12 mounted on mounting members 13. The first surface 11 is formed adjacent a front 14 of a vehicle 15 and the second surface 10 is formed adjacent

a bumper 16 attached to the front 14 of the vehicle 15. A strip member 20 is disposed between the two surfaces 10 and 11, passes over two fixed rollers or pulleys 22 situated at either end of the tensioner and passes to the underneath of the bonnet (not shown) of the vehicle 15 where the ends of the strip member 20 attach to movable pulleys 23. A separate cable 21 passes over the two pulleys 23 situated under the bonnet (not shown) of the vehicle 15, crosses over to opposite sides of the vehicle and attaches at each end to conventional front seat retractors 24 fitted to the vehicle to which seat belts 25 are attached.

Figs 2A and 2B show alternative configurations that the two surfaces may take. Fig 2A shows a plurality of part cyclinders 30 mounted on each of the mounting members 13 and Fig 2B shows continuous contoured members 35 mounted on each of the mounting members 13.

Figs 3A and 3B show how the two surfaces come together in the event of a collision. During a collision the second surface 10 experiences an impact and, as a result of this, moves towards the first surface 11 thus causing the cylinders 12 of the second surface to be forced into the spaces between the cylinders of the first surface. As the two rows come together as described the strip member 20 changes shape and tends to follow the contoured surfaces 10 and 11. It will be appreciated that this change of shape causes the cable 21 in Fig 1 to be pulled by the pulleys 23 and at the same time causes the seat belts 25 attached to the ends of the cable 21 to be pulled.

A system has been described which provides a fail-safe safety belt tensioner which operates in collisions. It is an inexpensive, purely mechanical device with a very fast response time relying purely on the vehicle's own energy for its operation.

It will be realised that although the description has been restricted to use of the device attached to the front of the vehicle it could also be attached to the back or even along the sides of the vehicle so that the seat belts will lock as described when the device receives an impact at the back or sides of the vehicle.

CLAIMS

1. A seat belt tensioner for use with a vehicle characterised in comprising a first contoured surface associated with a body of the vehicle and a second surface associated with a bumper mounted on the vehicle, a strip member disposed between them, the shape of the surfaces being such that as the two surfaces move towards each other the strip member changes shape and tends to follow the contours of the surfaces and ends of the strip member, being attached by attaching means to seat belt locking retractors, move in a way so as to cause tightening of seat belts attached to the seat belt locking retractors.

2. A seat belt tensioner as claimed in Claim 1 characterised in that the first surface is formed adjacent the body of the vehicle.

3. A seat belt tensioner as claimed in Claims 1 or 2 characterised in that the second surface is formed adjacent the bumper mounted on the vehicle.

4. A seat belt tensioner as claimed in Claims 1 or 3 characterised in that the first surface is formed on the body of the vehicle.

5. A seat belt tensioner as claimed in Claims 1 or 2 characterised in that the second surface is formed on the bumper mounted on the vehicle.

6. A seat belt tensioner as claimed in any previous claim characterised in that the first surface is defined by a plurality of cylindrical members mounted on a first mounting member.

7. A seat belt tensioner as claimed in any previous Claim characterised in that the second surface is defined by a plurality of cylindrical members mounted on a second mounting member.

8. A seat belt tensioner as claimed in Claims 6 and 7 characterised in that the cylindrical members are arranged such that when the two surfaces move towards each other the cylindrical members on one surface are urged into spaces between the cylindrical members on the other surface.

9. A seat belt tensioner as claimed in any one of Claims 1 to 5 characterised in that at least one surface is defined by a plurality of part cylindrical members mounted on a mounting member.

10. A seat belt tensioner as claimed in any one of Claims 1 to 5 characterised in that at least one surface is defined by a continuous contoured member mounted on a mounting member.

11. A seat belt tensioner as claimed in any previous claim, characterised in that the attaching means is a cable.

12. A seat belt tensioner as claimed in any previous claim characterised the strip member is a strip of conventional seat belt webbing.

13. A seat belt tensioner as claimed in any previous claim characterised the strip member is a steel strip.

Fig.1.

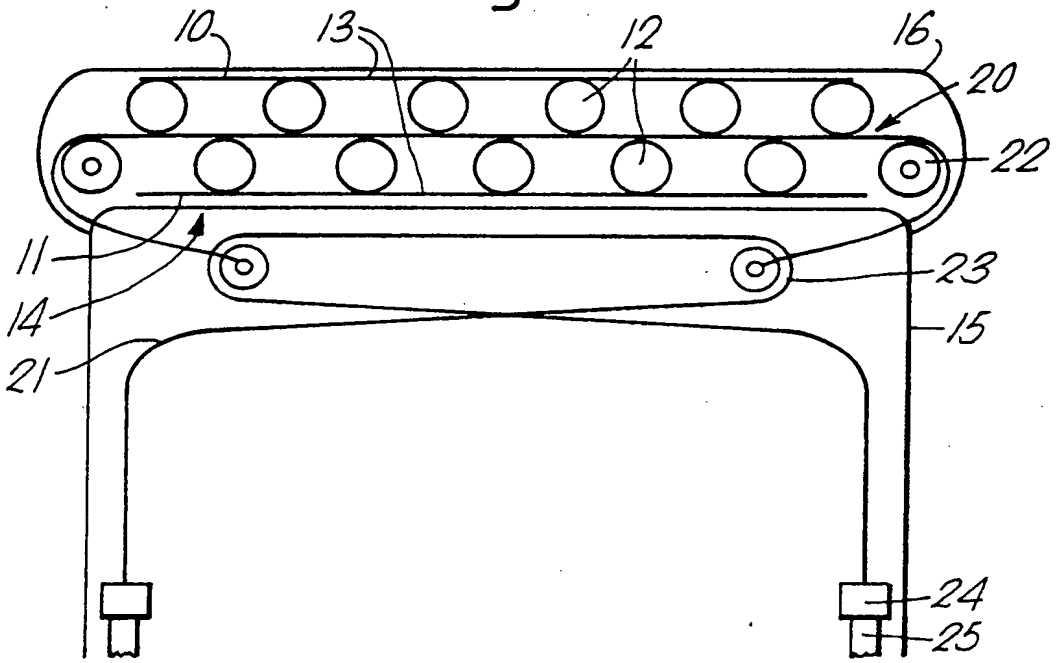


Fig.2A.

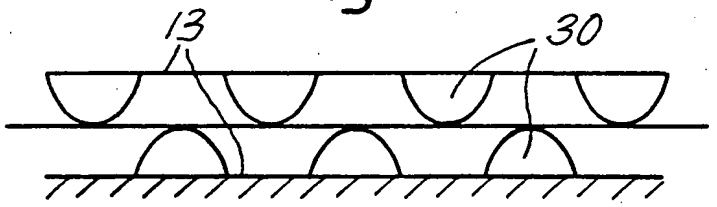


Fig.2B.

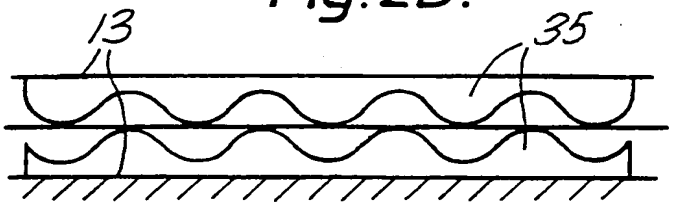


Fig. 3A.

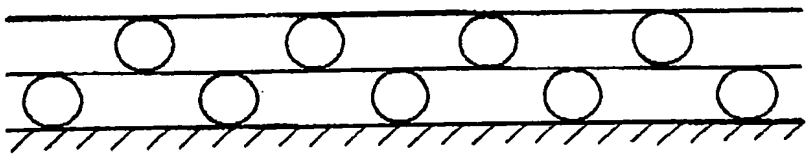


Fig. 3B.

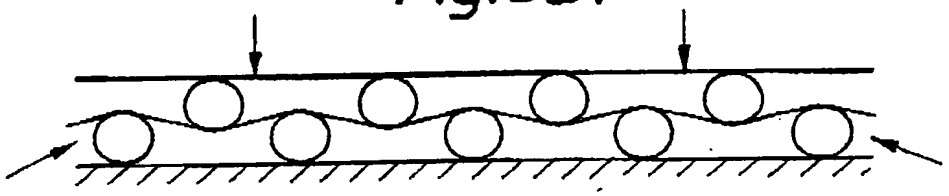
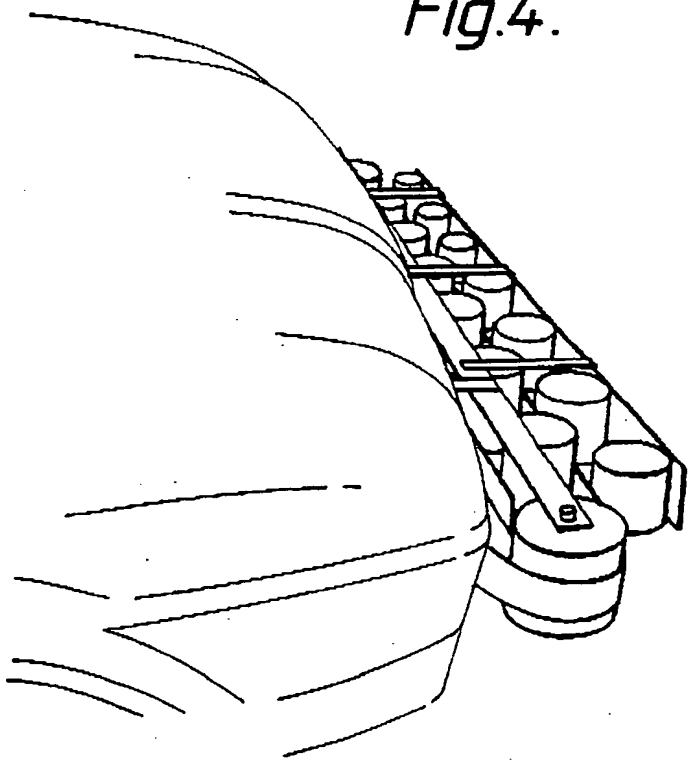


Fig. 4.



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/00768

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B60R21/00 ; B60R22/46

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B60R

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	DE,A,3417863 (BRITAX-KOLB GMBH & CO) 02 January 1986 see page 9, lines 11 - 31; figure 1 see page 10, lines 18 - 31	1, 11
Y		2-8
A	FR,A,1430501 (VARNEY) 04 March 1966 see page 1, column 2, lines 29 - 32; figure 3	1
Y		2-8
A	EP,A,234003 (AUDI AG) 02 September 1987 see column 5, line 8 - column 7, line 28; figures	1, 3, 4, 6, 11
A	DE,A,3736949 (VOLKSWAGEN AG) 28 July 1988 see column 2, line 29 - column 3, line 10; figure	1, 3, 4, 11

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
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Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,2903289 (KLIX) 08 September 1959 see column 1, lines 32 - 42; figures ---	4, 5, 9, 10

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-3417863	02-01-86	GB-A,B 2160411 JP-A- 60255544 US-A- 4597545	24-12-85 17-12-85 01-07-86
FR-A-1430501		None	
EP-A-234003	02-09-87	DE-A- 3605599 US-A- 4823905	27-08-87 25-04-89
DE-A-3736949	28-07-88	None	
US-A-2903289		None	

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